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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 20040115

Application Number: 09/761,486
Filing Date: January 16, 2001
Appellant(s): CHIOU ET AL.

Randy W. Tung
For Appellant

MAILED

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GROUP 1700

EXAMINER'S ANSWER

This is in response to the appeal brief filed on 11/3/2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is substantially correct. However, the appellant has omitted the status of Claims 3, 4, and 8. A complete and correct statement of the status of the claims is as follows:

This appeal involves Claims 1, 2, 5 – 7, and 9 – 17, which stand rejected.

Claims 3, 4, and 8 have been canceled.

No claims stand allowed.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of Claims 1, 2, 5, 9 – 11, and 13 – 17 under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (USPN 6,274,292 B1) stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

The rejection of Claims 6 and 7 under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (USPN 6,274,292 B1), in further view of Demirlioglu (USPN 6,063,704) stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

The rejection of Claims 1, 2, 6, 9 – 11, and 13 – 16 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1) stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

The rejection of Claims 5, 7, and 17 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN

6,265,751 B1), in further view of Sandhu et al. (USPN 6,268,282 B1) stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

The rejection of Claim 12 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1), in further view of either Lee (USPN 6,300,672) or Yao et al. (USPN 6,258,734 B1) stands or falls as a separate group.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

6,265,751	PLAT et al.	7-2001
6,274,292	HOLSCHER et al.	8-2001
6,063,704	DEMIRLIOGLU	5-2000
6,268,282	SANDHU et al.	7-2001
6,300,672	LEE	10-2001
6,258,734	YAO et al.	7-2001

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 2, 5, 9 – 11, and 13 – 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (6,274,292 B1). *Independent Claim 1 is representative of this group.*

Regarding independent **Claims 1 and 13**, Plat et al. teaches a method of depositing and condensing an anti-reflective coating (ARC) layer (Abstract), the method comprising providing a pre-processed semiconductor substrate coated with and having a polysilicon layer on a top surface (Figure 4B, reference number "112"; Col.4, lines 35 – 39; Col.6, lines 5 – 12), depositing a dielectric ARC layer on the polysilicon layer, wherein the dielectric ARC layer is deposited of a material typically being SiON (Figure 4B, reference number "114"; Col.4, lines 37 – 39; Col.5, lines 49 – 54; Col.6, lines 12 – 15), and annealing / heating the dielectric ARC layer deposited on the semiconductor substrate at a temperature of at least 400° C, particularly between about 400° C and about 1000° C, in a gas / environment comprising at least one of N_2 or O_2 (Figure 4B, reference number "116"; Col.6, lines 15 – 18 and 59 – 67). Specifically, Plat et al. teaches annealing the dielectric ARC at a temperature between 800 and 900 degrees Fahrenheit (i.e., 427° C to 482° C) in an oxygen gas environment (Col.6, lines 59 – 65). Plat et al. does not explicitly teach that the dielectric ARC layer is either SiO_2 or SiONH. Specifically, Plat et al. teaches that a "conventional ARC layer" is provided on the

polysilicon layer (Col.2, lines 47 – 49), and that the ARC layer is typically and preferably SiON (Col.4, lines 38 – 39; Col.5, lines 53 – 54). However, the process of Plat et al. does not appear to be limited to solely a SiON ARC layer (Col.5, lines 30 – 40; Col.8, lines 6 – 13). Holscher et al. teaches the functional equivalence of a SiON dielectric ARC layer (i.e., as taught by Plat et al.) and a SiONH dielectric ARC layer (i.e., as claimed by the applicant) in the art of reducing reflections during the patterning of photoresist layers in semiconductor device applications (Col.1, lines 5 – 57; Col.2, lines 56 – 65). Therefore, it would have been obvious to one of ordinary skill in the art to substitute a SiONH dielectric ARC layer (i.e., as taught by Holscher et al.) for the SiON dielectric ARC layer in the process of Plat et al. with the reasonable expectation of (1) success, as SiON and SiONH dielectric ARC layers are extremely chemically similar, and (2) obtaining similar results, specifically depositing a conventional ARC layer to a desired thickness on a polysilicon layer and then annealing the ARC layer to densify it, as desired by Plat et al., regardless of whether a SiON ARC or a SiONH ARC is utilized. While the combination of Plat et al. and Holscher et al. presented above does not explicitly teach that the method is used for adjusting the optical properties of an ARC layer (Claim 1), or for adjusting the extinction coefficient of the ARC layer (Claim 13), the combination of Plat et al. and Holscher et al. does teach all of the process steps and limitations of the appellant's claims, including the specific annealing temperature, annealing time, and annealing gas claimed and disclosed by the appellant. Therefore, the method of the combination of Plat et al. and Holscher et al. would have inherently adjusted the optical properties, such as the extinction coefficient, of the ARC layer.

Although Claims 2, 5, 9 – 11, and 13 – 17 stand or fall together with Claim 1 (which has been discussed at length above), the following statement of rejection is provided to add to the completeness of the record. The combination of Plat et al. and Holscher et al. teaches all the limitations of Claims 2, 5, 9 – 11, and 14 – 17 as set forth in the paragraph immediately above and in the discussion below, including a method wherein / further comprising:

- Claim 2 – The dielectric ARC layer is SiONH (see the discussion of Claims 1 and 13 above).
- Claim 5 – The gas used in the annealing process is O_2 (Col.6, lines 64 – 65 of Plat et al.).
- Claim 9 – The annealing is performed at a temperature between about 400° C and about 1000° C (Col.6, lines 59 – 65 of Plat et al.).
- Claims 10 - 11 – The annealing is performed for a time period between about 1 minute and about 30 minutes (Claim 10), preferably between about 3 minutes and about 5 minutes (Claim 11) (Col.6, lines 63 – 64 of Plat et al.).
- Claim 14 – The heating is performed for a length of time sufficient to vary the extinction coefficient of the ARC layer by at least 10%. While this limitation is not explicitly taught by the combination of Plat et al. and Holscher et al., Plat et al. does teach performing the appellant's claimed process at temperatures in the range claimed by the appellant. In addition, Plat et al. teaches an annealing time of up to thirty minutes (Col.6, lines 63

– 64), which is the same upper limit for annealing time contemplated by the appellant. Therefore, the method of the combination of Plat et al. and Holscher et al. would have inherently varied the extinction coefficient of the ARC layer by at least 10%.

- Claims 15 – 16 – The heating is performed for a length of time between about 1 minute and about 30 minutes, specifically between about 3 minutes and about 5 minutes (Col.6, lines 60 – 65 of Plat et al.).
- Claim 17 – Heating the semiconductor substrate to a temperature between 400° C and 700° C in an environment of O_2 (see the discussion of Claims 1 and 13 above).

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (6,274,292 B1), and in further view of Demirlioglu (USPN 6,063,704). *Claim 6 is representative of this group.*

The combination of Plat et al. and Holscher et al. teaches all the limitations of **Claim 6** as set forth above in the discussion of Claim 1, except for a method wherein the gas used in the annealing process is N_2. Specifically, Plat et al. teaches that the gas used in the annealing process can be O_2 (Col.6, lines 64 – 65), but the gas used in the process does not appear to be limited to O_2 alone. In addition and importantly, the annealing process of Plat et al. is designed to densify the dielectric ARC layer (Col.5, lines 45 – 67, and Col.6, lines 59 – 67). Demirlioglu teaches that it was known in the art at the time of the appellant's invention to densify a dielectric ARC layer in a semiconductor device

by annealing the layer in an inert ambient such as N_2 (Abstract and Col.8, lines 16 – 26). Therefore, it would have been obvious to one of ordinary skill in the art to utilize N_2 in the annealing process of Plat et al. with the reasonable expectation of successfully densifying the dielectric ARC layer of the combination of Plat et al. and Holscher et al., as desired by Plat et al. and taught by Demirlioglu. In addition, by using an inert gas such as N_2 in the annealing process instead of a flammable gas such as O_2, one of ordinary skill in the art would have obtained the benefit of reducing the risk of fire and explosion in the process, thereby increasing the safety of the process.

Although Claim 7 stands or falls together with Claim 6 (which has been discussed at length above), the following statement of rejection is provided to add to the completeness of the record. The combination of Plat et al., Holscher et al., and Demirlioglu teaches all the limitations of Claim 7 as set forth immediately above, except for a method wherein the gas used in the annealing process is a mixture of O_2 and N_2. However, Plat et al. teaches annealing in oxygen gas to densify the ARC layer. In addition, it would have been obvious to one of ordinary skill in the art to utilize nitrogen gas in the annealing process to densify the ARC layer for the reasons set forth immediately above. Therefore, since one of ordinary skill in the art would have reasonably expected both oxygen and nitrogen to function effectively as the annealing gas in the process of the combination of Plat et al. and Holscher et al., it would have been obvious to one of ordinary skill in the art to use a combination of the two gases with the reasonable expectation of success and obtaining similar results (i.e., effectively increasing the density of a dielectric ARC layer by annealing the layer, as desired by

Plat et al.), absent any showing of criticality or unexpected results obtained by using a mixture of the two gases as opposed to either gas individually.

Claims 1, 2, 6, 9 – 11, and 13 – 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1). *Independent Claim 1 is representative of this group.*

Regarding independent **Claims 1 and 13**, Holscher et al. teaches a method for adjusing the optical properties / extinction coefficient of a dielectric ARC layer (Abstract, Col.2, lines 56 – 67, and Col.3, lines 58 – 60), the method comprising providing a preprocessed semiconductor substrate (Col.2, lines 38 – 55), depositing a dielectric ARC layer on the substrate, wherein the ARC layer is deposited of a material preferably being either SiON or <u>SiONH</u> (Col.2, lines 41 – 42 and 56 – 67; Col.3, lines 21 – 22), and heating / annealing the dielectric ARC layer deposited on the semiconductor substrate at a temperature of at least 400° C, particularly between about 400° C and about 1000° C, in an environment / gas which comprises at least one of N_2 or O_2 (Col.3, lines 20 – 37). Holscher et al. does not explicitly teach that the ARC layer is deposited on either a SiN_x or a polysilicon layer which is provided on top of the semiconductor substrate. However, it is the intention of Holscher et al. to provide an effective ARC layer that can be used <u>on top of a reflective layer</u> and beneath a photoresist layer to suppress reflected radiation waves from the reflective layer (Col.1, lines 5 – 57). Importantly, Holscher et al. also teaches that the semiconductive substrate on which the ARC layer is deposited includes a semiconductive wafer alone <u>as well as assemblies comprising</u>

other materials thereon (Col.2, lines 46 – 55). In other words, the process of Holscher et al. is open to any number of conventionally deposited layers being present between the dielectric ARC layer and the semiconductor substrate. Plat et al. teaches that, in conventional semiconductor devices, an ARC layer is deposited on top of a polysilicon layer to reduce reflections, and a photoresist layer is then patterned on top of the ARC layer (Col.1, lines 21 – 35; Col.2, lines 26 – 38 and 47 – 49). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the SiONH ARC layer of Holscher et al. on top of a polysilicon layer that has been deposited on top of the semiconductive substrate of Holscher et al. with the reasonable expectation of (1) success, as Holscher et al. teaches that their ARC layer can be deposited on either a semiconductor substrate or on a semiconductor substrate with other materials thereon, and (2) obtaining the benefit of reducing the reflections from a reflective layer, specifically a polysilicion layer, by depositing the ARC layer on the polysilicon layer prior to photoresist processing, as desired by Holscher et al. and taught by Plat et al. In other words, it would have been obvious to one of ordinary skill in the art perform the process of Holscher et al. on a polysilicon-coated semiconductor substrate because it is the goal of Holscher et al. to suppress reflected radiation in a photoresist patterning process in general, and Plat et al. teaches that such a goal (i.e., suppressing reflected radiation in a photoresist patterning process) is applicable to polysilicon-coated semiconductor substrates.

Although Claims 2, 6, 9 – 11, and 13 – 16 stand or fall together with Claim 1 (which has been discussed at length above), the following statement of rejection is provided to

add to the completeness of the record. The combination of Holscher et al. and Plat et al. also teaches all the limitations of Claims 2, 6, 9 – 11, and 14 – 16 as set forth in the paragraph immediately above and in the discussion below, including a method wherein / further comprising:

- Claim 2 – The dielectric ARC is SiONH (Col.2, lines 56 – 61, and Col.3, lines 25 – 28 of Holscher et al.).
- Claim 6 – The gas used in the annealing process is N_2 (Col.3, lines 33 – 37 of Holscher et al.).
- Claim 9 – The annealing is performed at a temperature between about 400° C and about 1000° C (Col.3, lines 20 – 33 of Holscher et al.).
- Claims 10 - 11 – The annealing is performed for a time period between about 1 minute and about 30 minutes, particularly between about 3 minutes and about 5 minutes. Specifically, Holscher et al. is silent as to the annealing time period. However, Holscher et al. teaches that the annealing is performed to <u>alter at least one of the refractive index or the extinction coefficient of the ARC layer</u> (Col.3, lines 58 – 60). One of ordinary skill in the art would have readily recognized the annealing time as a result / effective variable that would have been expected to influence the final properties of the ARC layer (i.e., the longer the annealing time, the larger the change in the optical properties of the layer such as refractive index and extinction coefficient). Further, Plat et al. teaches that it was known in the art at the time of the appellant's invention to anneal an ARC layer for a time

period between approximately 5 and 30 minutes (Col.6, lines 63 – 64). Therefore, it would have been obvious to one of ordinary skill in the art to perform the annealing process of Holscher et al. for a time period of between approximately 5 and 30 minutes (as taught by Plat et al.) with the reasonable expectation of success. Further, absent any showing of criticality or unexpected results, the exact annealing time would have been optimized through routine experimentation by one of ordinary skill in the art, depending on the desired degree of change in the optical properties of the ARC layer.

- Claim 14 – The heating is performed for a length of time sufficient to vary the extinction coefficient of the ARC layer by at least 10% (Col.3, lines 55 – 60 of Holscher et al.).
- Claims 15 – 16 – The heating is performed for a length of time between about 1 minute and about 30 minutes, specifically between about 3 minutes and about 5 minutes (See the discussion of Claims 10 – 11 above).

Claims 5, 7, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1), and in further view of Sandhu et al. (USPN 6,268,282 B1). *Claim 5 is representative of this group.*

The combination of Holscher et al. and Plat et al. teaches all the limitations of **Claims 5 and 17** as set forth in the discussion above, except a method wherein the gas

/ environment used in the annealing process is O_2. However, it is the aim of Holscher et al. to anneal an ARC layer such as a SiONH layer in order to alter at least one of the refractive index or extinction coefficient of the ARC layer (Col.3, lines 58 – 60). Sandhu et al. teaches that, when annealing an ARC material in an oxygen environment, the annealing alters the refractive index and the extinction coefficient of the ARC layer (Col.2, lines 35 – 47). Therefore, it would have been obvious to one of ordinary skill in the art to use oxygen as the gas in the annealing process of Holscher et al. with the reasonable expectation of successfully and advantageously altering at least one of the refractive index or extinction coefficient of the ARC layer, as desired by Holscher et al. and taught by Sandhu et al.

Although Claims 7 and 17 stand or fall together with Claim 5 (which has been discussed at length above), the following statement of rejection is provided to add to the completeness of the record. The combination of Holscher et al., Plat et al., and Sandhu et al. teaches all the limitations of Claim 7 as set forth in the paragraph immediately above, except for a method wherein the gas used in the annealing process is a mixture of O_2 and N_2. However, Holscher et al. teaches that the annealing process gas used can comprise nitrogen (Col.3, lines 35 – 37). In addition, it would have been obvious to one of ordinary skill in the art to use oxygen as the gas in the annealing process of Holscher et al. for the reasons set forth in the paragraph immediately above. Therefore, since one of ordinary skill in the art would have expected both oxygen and nitrogen to function effectively as the annealing gas in the process of Holscher et al., it would have been obvious to one of ordinary skill in the art to use a combination of the two gases

with the reasonable expectation of success and obtaining similar results (i.e., successfully annealing a dielectric ARC layer in order to alter the optical properties thereof), absent any showing of criticality or unexpected results of using a mixture of the two gases as opposed to either gas individually.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1), and in further view of either Lee (USPN 6,300,672 B1) or Yao et al. (USPN 6,258,734 B1).

The combination of Holscher et al. and Plat et al. teaches all the limitations of **Claim 12** as set above, except a method wherein the annealing process adjusts the refractive index of the ARC layer to between about 2.0 and 2.5 and the extinction coefficient to between about 0.2 to 0.8. However, it is the goal of Holscher et al. to adjust the refractive index and the extinction coefficient of a SiONH ARC layer to a desirable value in order to reduce reflections during subsequent photoresist processing. Lee teaches that typical ARC layers used in semiconductor devices during photoresist patterning (i.e., a process analogous to that of both Holscher et al. and Plat et al.) have a refractive index of about 1.60 – 3.6 and an extinction coefficient of about 0.01 – 2.0 (Abstract and Col.5, lines 25 – 31). Yao et al. teaches that <u>key characteristics</u> of an ARC layer used in semiconductor devices during photoresist patterning include a refractive index of between about 1.85 and 2.35 and an extinction coefficient of between about 0.45 and 0.75 (Abstract and Col.2, lines 9 – 27). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the refractive index of the ARC layer of the combination

of Holscher et al. and Plat et al. to between about 2.0 and 2.5 and the extinction coefficient to between about 0.2 to 0.8, as taught by either Lee or Yao et al., with the reasonable expectation of (1) success, as Holscher et al. teaches that the annealing of an ARC layer such as a SiON or SiONH layer alters at least one of the refractive index or extinction coefficient of the ARC layer, and (2) advantageously obtaining refractive index and extinction coefficient values for an ARC layer that are desired in the art, as taught by either Lee or Yao et al.

(11) Response to Argument

The appellant's arguments are presented in order, starting with Issue I and finishing with Issue V. In the sections below, the examiner will fully address each of the appellant's arguments in the order in which they are presented in the Appeal Brief.

Issue I

Issue I is drawn to the rejection of Claims 1, 2, 5, 9 – 11, and 13 – 17 under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (6,274,292 B1).

Regarding the 35 U.S.C 103(a) rejection based on Plat et al. in view of Holscher et al., the appellant argues that the process of Plat et al. (as stated by Plat et al. on Col.5, lines 60+) involves condensing the ARC layer to approximately the desired thickness and that, "...condensing the ARC layer does not adversely affect the anti-reflective properties of the ARC layer" in Plat et al., and therefore, Plat et al.'s process achieves a

completely different result than that achieved by the present invention and is used for a completely different purpose than the method of the present invention.

In response, the examiner notes that this argument is drawn to the Plat et al. reference alone, while the rejections are based on the combination of Plat et al. and Holscher et al. Please note that one cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Additionally, the examiner does not dispute the appellant's assertion that the process of Plat et al. involves condensing the ARC layer to approximately the desired thickness and that, "...condensing the ARC layer does not adversely affect the anti-reflective properties of the ARC layer". However, the appellant's claims are open to (i.e., do not exclude) the situation in which the ARC layer is condensed by the annealing process. Further, Plat et al.'s teaching that the anti-reflective properties of the ARC layer are not <u>adversely</u> affected by the condensing (i.e., annealing) process does not mean or suggest that the properties are not changed or altered at all – it simply means that the properties are not detrimentally affected. For example and as noted by the appellant (see the paragraph bridging pages 7 – 8 of the Appeal Brief), the condensing step of Plat et al. decreases the thickness of the ARC layer, a process that would necessarily and inherently affect and alter the anti-reflective properties of an ARC (i.e., because the anti-reflective properties of an ARC are dependent on the thickness of the ARC itself). For support of the examiner's position, please see Col.2, lines 26 – 27, and Col.4, lines 39 – 41 of Plat et al., in which Plat et al.

explicitly teaches that the anti-reflective properties of an ARC layer are highly dependent on the thickness of the layer. In addition, the examiner agrees with the appellant that the stated purpose of the annealing process of Plat et al. (i.e., condensing the ARC) is different from the stated purpose of the appellant's claimed process (i.e., to adjust the optical properties such as the refractive index (n) and/or extinction coefficient (k) of the ARC). However, the appellant's statement that Plat et al.'s process achieves a completely different result than the claimed process is not convincing. Specifically, the combination of Plat et al. and Holscher et al. teaches all the process steps and limitations of the applicant's claims, including the type of substrate, the nature of the ARC (i.e., SiONH), the annealing temperature, the annealing time, and the type of gas used in the annealing process. Therefore, the method of the combination of Plat et al. and Holscher et al. would have inherently adjusted the optical properties, such as the extinction coefficient, of the ARC layer as claimed by the appellant. Please note that the fact that appellant has recognized another advantage (i.e., that an ARC annealing process such as the one taught by Plat et al. alters the optical properties of the ARC) which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Second, the appellant argues that, in the present invention, the specific combination of the dielectric ARC layer / substrate surface is used to maximize the compatibility between the two, and Plat et al. is not concerned with and does not recognize such a

compatibility problem. In other words, the appellant argues that Plat et al. does not teach the desirability or need to use a material other than SiON as the ARC material, while the present invention clearly shows the necessity of utilizing an SiONH or SiO_2 dielectric ARC layer on a substrate surface of polysilicon or silicon nitride, thereby solving a specific problem (i.e., compatibility) not recognized by the prior art. As support for this argument, the appellant cites page 3, line 8, through page 4, line 1, of the specification.

In response, this argument is not convincing for the following reasons. Specifically, the examiner disagrees with the appellant's assessment, i.e., the appellant's statement that the present invention clearly shows the necessity of utilizing an SiONH or SiO_2 dielectric ARC layer. This is not the case. For example, the examiner reviewed page 3, line 8, through page 4, line 1, of the appellant's specification (i.e., the portion of the specification cited by the appellant), and this portion of the specification teaches that, for compatibility reasons, <u>a dielectric type anti-reflective coating material</u> is more suitable for coating the polysilicon or the silicon nitride surface. The appellant's specification does not assert or suggest that there is any criticality or compatibility advantage gained by using an SiONH or SiO_2 dielectric ARC (as presently claimed by the appellant) as opposed to an SiON dielectric ARC (as taught by Plat et al.). In fact, the specification of the instant application explicitly teaches that the <u>dielectric ARC may be SiO_2, SiON, or SiONH</u> (page 3, lines 18 – 20), which contradicts the appellant's argument. The examiner also wishes to note that utilizing SiON as the dielectric ARC was originally claimed by the appellant (see, for example, originally filed Claims 2 – 4) but is no longer

being claimed due to appellant's amendments. The examiner maintains that Plat et al., which teaches all of the appellant's process steps but uses an SiON ARC as opposed to an SiONH or SiO_2 ARC, and Holscher et al., which teaches the functional equivalence of an SiON ARC and an SiONH ARC, in combination, reasonably suggest each and every limitation of the appellant's claims.

Third, the appellant states that a rejection under 35 U.S.C. 103(a) must rest on a factual basis, and in the present case, the appellant argues that the conclusion drawn by the examiner that the method of the combination of Plat et al. and Holscher et al. would have inherently adjusted the optical properties of the ARC layer is based on hindsight reconstruction, is mere speculation, and is not supported by solid evidence.

In response, the appellant's argument is not convincing, and the examiner disagrees with the appellant's position that the conclusion drawn by the examiner is mere speculation and based on hindsight reconstruction. The examiner maintains that the process reasonably suggested by the combination of Plat et al. and Holscher et al. would have inherently adjusted the optical properties of the ARC layer. In support of this position, the examiner notes that the condensing step of Plat et al. <u>decreases the thickness of the ARC layer</u>, a process that would necessarily (i.e., inherently) affect and alter the anti-reflective properties of an ARC. In more detail, the thickness of an ARC layer (or any thin coating layer, for that matter) determines in what manner and to what extent light waves are refracted, reflected, absorbed, and transmitted as the light waves reach the ARC, thereby determining the anti-reflective (i.e., optical) properties of the

ARC. For further support of the examiner's position, please see Col.2, lines 26 – 27, and Col.4, lines 39 – 41 of Plat et al., in which Plat et al. explicitly teaches that the anti-reflective properties of an ARC layer are highly dependent on the thickness of the layer. This is solid evidence supporting the examiner's position. Additionally, the examiner notes that the combination of Plat et al. and Holscher et al. teaches all the process steps and limitations of the appellant's claims, including the type of substrate, the nature of the ARC (i.e., SiONH), the annealing temperature, the annealing time, and the type of gas used in the annealing process. Therefore, the method of the combination of Plat et al. and Holscher et al. would have inherently adjusted the optical properties, such as the extinction coefficient, of the ARC layer, as claimed by the appellant. In response to appellant's argument that the examiner's conclusion is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the appellant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). In this case, all the evidence of obviousness relied upon by the examiner was within the level of ordinary skill at the time the claimed invention was made and was not gleaned only from the appellant's disclosure.

Fourth, the appellant argues that there is no motivation to combine Plat et al. with Holscher et al. because Plat et al. does not contain any teaching or suggestion that the

SiON ARC layer is not compatible with the substrate surface, and Holscher et al. does not contain any teaching or suggestion that the SiONH ARC layer is especially compatible with certain substrate surfaces.

In response, this argument is not convincing, and the examiner disagrees with the appellant's statement that there is no reason or motivation to combine Plat et al. with Holscher et al. Briefly, Plat et al. teaches that an ARC layer is provided on the polysilicon layer (Col.2, lines 47 – 49), and that the ARC layer is typically and preferably SiON (Col.4, lines 38 – 39). However, the process of Plat et al. does not appear to be limited to solely a SiON ARC layer. Holscher et al. teaches the functional equivalence of a SiON dielectric ARC layer (i.e., as taught by Plat et al.) and a SiONH dielectric ARC layer (i.e., as claimed by the appellant) in the art of reducing reflections during the patterning of photoresist layers in semiconductor device applications (Col.2, lines 56 – 65). Therefore, it would have been obvious to one of ordinary skill in the art to substitute a SiONH dielectric ARC layer (i.e., as taught by Holscher et al.) for the SiON dielectric ARC layer in the process of Plat et al. with the reasonable expectation of (1) success, as SiON and SiONH dielectric ARC layers are extremely chemically similar, and (2) obtaining similar results, specifically depositing an ARC layer to a desired thickness on a polysilicon layer and then annealing the ARC layer to densify it, as desired by Plat et al. Please note that a substitution of art-recognized equivalents, such as substituting SiONH for SiON as an ARC, is a sufficient motivation to combine references and to support an obviousness rejection (See, for example, MPEP 2144.06). An express suggestion to substitute one equivalent component for another is not necessary to

render such substitution obvious (*In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

Issue II

Issue II is drawn to the rejection of Claims 6 and 7 under 35 U.S.C. 103(a) as being unpatentable over Plat et al. (USPN 6,265,751 B1) in view of Holscher et al. (6,274,292 B1), in further view of Demirlioglu (USPN 6,063,704).

The appellant argues that Claims 6 and 7 depend on independent Claim 1, which the appellant has clearly shown is not reasonably suggested by the combination of Plat et al. and Holscher et al., and that the additional Demirlioglu reference does not lend any additional weight to the 103(a) rejection of Claims 6 and 7.

In response, the appellant's argument is not convincing because the examiner has clearly shown that the combination of Plat et al. in view of Holscher et al. reasonably suggests all of the limitations of appellant's Claim 1 (from which Claims 6 and 7 depend). See the "Grounds of Rejection" and "Response to Argument" sections above. Additionally, please note that the appellant has not stated or argued that the examiner has improperly interpreted or applied the Demirlioglu reference.

Issue III

Issue III is drawn to the rejection of Claims 1, 2, 6, 9 – 11, and 13 – 16 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1).

The appellant argues that the combined teachings of Holscher et al. and Plat et al. do not teach the invention contained in independent Claims 1 and 13, since neither reference recognizes the problem of compatibility, and therefore, neither reference provides such a solution, as provided by the present invention. In other words, the appellant argues that Holscher et al. does not teach that their SiONH ARC layer is especially suitable for improving compatibility with certain substrate surfaces, while Plat et al. does not contain any teaching that an SiON ARC layer is inadequate in any way due to compatibility problems.

In response, this argument is not convincing at least because the appellant has failed to show that an SiONH ARC layer is superior in any way, including compatibility, when compared to an SiON ARC or any other dielectric ARC. For example, the examiner reviewed the appellant's specification (page 3, line 8, through page 4, line 1), which teaches that, for compatibility reasons, a dielectric type anti-reflective coating material is more suitable for coating the polysilicon or the silicon nitride surface. The appellant's specification does not assert or suggest that there is any criticality or compatibility advantage gained by using an SiONH or SiO_2 dielectric ARC (as presently claimed by the appellant) as opposed to an SiON dielectric ARC (as taught by Plat et al.). In fact, the specification of the instant application explicitly teaches that the <u>dielectric ARC may be SiO_2, SiON, or SiONH</u> (page 3, lines 18 – 20), which contradicts the appellant's argument. The fact that appellant has recognized another advantage (i.e., that dielectric ARCs are especially compatible with and suitable for coating polysilicon and silicon nitride surfaces) which would flow naturally from following the

suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). In other words, it appears to the examiner that the reason that Plat et al. and Holscher et al. do not discuss ARC "compatibility problems" at length is that the specific ARCs taught by Plat et al. and Holscher et al. (e.g., SiONH, SiON, etc.) are <u>dielectric ARCs and do not have compatibility problems</u>, which is the advantage of dielectric ARCs recognized by the appellant.

Issue IV

Issue IV is drawn to the rejection of Claims 5, 7, and 17 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1), and in further view of Sandhu et al. (USPN 6,268,282 B1).

The appellant states that Claims 5 and 7 depend on independent Claim 1, while Claim 17 depends on independent Claim 13, which independent claims the appellant has clearly shown are not reasonably suggested by the combination of Holscher et al. and Plat et al., and that the additional Sandhu et al. reference does not lend any additional weight to a 103(a) rejection.

In response, the appellant's argument is not convincing because the examiner has clearly shown that the combination of Holscher et al. and Plat et al. reasonably suggests all of the limitations of appellant's Claim 1 (from which Claims 5 and 7 depend) and Claim 13 (from which Claim 17 depends). See the "Grounds of Rejection" and applicable "Response to Argument" sections above. Additionally, please note that the

appellant has not stated or argued that the examiner has improperly interpreted or applied the Sandhu et al. reference.

Issue V

Issue V is drawn to the rejection of Claim 12 under 35 U.S.C. 103(a) as being unpatentable over Holscher et al. (USPN 6,274,292 B1) in view of Plat et al. (USPN 6,265,751 B1), and in further view of either Lee or Yao et al.

The appellant states that Claim 12 depends on independent Claim 1, which the appellant has clearly shown is not reasonably suggested by the combination of Holscher et al. and Plat et al., and that the additional references of Lee and Yao et al. do not lend any additional weight to a 103(a) rejection of Claim 12.

In response, the appellant's argument is not convincing because the examiner has clearly shown that the combination of Holscher et al. and Plat et al. reasonably suggests all of the limitations of appellant's Claim 1 (from which Claim 12 depends). See the "Grounds of Rejection" and applicable "Response to Argument" sections above. Additionally, please note that the appellant has not stated or argued that the examiner has improperly interpreted or applied the Lee and/or Yao et al. references.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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